REMARKS

In response to the Office Action of November 15, 2005, the Applicant submits this Reply. In view of the foregoing amendments and following remarks, reconsideration is requested.

Claims 1-9 remain in this application, of which claims 1, 4 and 7 are independent. No fee is due for claims for this Reply.

Rejection Under 35 U.S.C. §103

Claims 1-6, of which claims 1 and 4 are independent, were rejected under 35 U.S.C. §103 in view of U.S. Patent 6,522,331 ("Danks") and U.S. Patent 6,798,415 ("Lake"). The rejection is respectfully traversed.

Lake is relied upon only for showing quaternion interpolation. The following argument assumes, for the sake of argument only and without agreeing with the proposition, that Danks is modified to use quaternion interpolation for interpolating animations.

According to Danks, a "character in computer animation is typically represented by a skeleton. A skeleton typically consists of a bone for each moving part of the skeleton." Col. 1, Lines 17-19. "Each bone is defined in terms of a translation, a rotation, and a parent. The parent is the bone immediately above the given bone in the skeleton hierarchy. The translation and rotation are the distance and direction of the given bone, respectively, from its parent." Col. 1, lines 32-35. "Taken together, the rotation and the translation specify the location of a bone relative to its parent." Col. 4, lines 13-15. See also, Col. 3, line 66 to Col. 4, line 20. "Since each bone is defined in terms of its parent bone, moving the parent bone causes each child bone to move as well." Col. 4, lines 21-23. "An animation of the skeleton . . . has two aspects: rotation [which includes both rotation and translation – see Col. 4, lines 32-33] and time. The rotation is the amount of rotation to apply to a given bone of the skeleton. The time is how long the specified rotation should take to complete." Col. 4, lines 34-38. "Directed acyclic graphs (DAGs) [are used] to control the animation." Col. 5, line 56. "DAGs [provide] smooth transitions between animation sequences." Col. 9, lines 44-45. "A transition combine node . . . can be used, for example, to interpolate animation between two input animations to create a seamless transition from the first animation to the second over a specified time period." Col. 7, lines 30-33. Thus, for example, in Fig. 5B, its use can provide "smooth transitions from idling to

running." "Different types of transition nodes can produce different types of interpolations, including linear, spherical, power function, and bias function interpolations." Col. 7, lines 33-36. Danks does not mention quaternion interpolation.

The Office Action asserts that Danks teaches determining an amount of "roll" because Danks determines the rotation time period. See Office Action, page 3, lines 5-6. However, Danks uses the terms "rotation" and "direction" interchangeably. In particular, Danks says "[e]ach bone is defined in terms of a translation, a rotation, and a parent. The parent is the bone immediately above the given bone in the skeleton hierarchy. *The translation and rotation are the distance and direction of the given bone, respectively, from its parent.*" Col. 1, lines 32-35 (emphasis added). Therefore, when Danks discusses interpolating rotation, this means interpolating the distance and direction for a bone from its parent, and not "roll" as claimed. The claims distinguish between an object's position, direction and roll, whereas Danks only considers position and direction of a bone from a parent reference object, but not roll around the direction.

Regarding interpolation in Danks, an animation is defined by an amount of rotation (a rotation and translation) to apply to *a given bone* and time (how long the rotation should take to complete). See Col. 4, lines 35-40. An animation is applied to each bone, and "sets of animation for individual bones can be aggregated to provide an animation for a particular action. See Col. 4. lines 35-47. Thus, in an animation, for each bone in each frame of the animation, interpolation is performed over the specified time between the initial distance and direction for the bone from its parent and the final distance and direction for the bone from its parent.

This kind of interpolation is different from the interpolation used by the combiner, which interpolates between animations in a transition. In Danks, a first animation state is transitioned to a second animation state by interpolating between animations. See Col. 7, lines 30-34. In a transition between animations, for each frame in the transition, the distance and direction of each bone with respect to its parent is determined by interpolating between that bone's distance and direction with respect to its parent in that frame in one animation and that bone's distance and direction with respect to its parent in that frame in the other animation.

It appears that the Office Action is relying on a proposition that a "path" is a line over time between an initial distance and direction of the bone in a first animation (e.g., an idle state) and its final distance and direction in a second animation (e.g., a running state). In Danks,

however, only the distance and direction (but not roll around the direction) for one bone is determined along such a path.

In contrast to Danks, the present invention involves "a path in a three dimensional model" (see claim 1). The invention is applicable, for example, in three-dimensional modeling, to permit interconnected three-dimensional structures along a path (such as elements of a spine) to be rotated (in both direction and roll) naturally by specifying the poses of control objects associated with a path along which the interconnected elements are positioned, thus avoiding tedious modeling of every structure in the model.

Danks does not perform interpolation along a path *in a three dimensional model*. The path referred to in the Office Action is a path over time between the initial distance and direction of the bone and its final distance and direction. Such a path is not a path over time is not a path "in a three dimensional model," as claimed.

Danks' does not to determine both a direction *and an amount of roll around the direction* for each intermediate position along that path. Danks teaches only computing, for a bone, distance (translation) and direction (rotation) with respect to its parent bone. The claims involve computing a direction *and* an amount of roll.

The system of Danks involves animating bones over time, not positioning multiple three dimensional structures along a path in a three dimensional model, as in the claimed invention.

In summary, independent claims 1 and 4 involve "interconnected three-dimensional structures in three dimensions along the defined path in the three-dimensional object." The claims also recite "each three-dimensional structure is associated with a different intermediate position along the path and a direction at its intermediate position." The claims also recite that "amount of roll around the direction for each of the one or more interconnected three-dimensional structures" is determined. The interpolation between animations in Danks does not meet this claim language at least because a. in Danks there is no path *in the three dimensional model* along which multiple three dimensional structures are placed at intermediate positions and for which a direction *and an amount of roll* are determined through interpolation between two poses associated with that path, and b. in Danks there is no roll around a direction for an object. In Danks, direction from a parent bone is the bone's rotation, and such "rotation" does not signify "roll" as claimed.

For these reasons, it is respectfully submitted that the independent claims 1 and 4 are patentable over Danks and Lake. The remaining claims are dependent claims that are allowable for at least similar reasons.

New Claims

New claims 7-9 are computer program product claims that correspond to claims 4-6 and are allowable for at least similar reasons.

CONCLUSION

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after this reply, that the application is not in condition for allowance, the Examiner is requested to call the Applicants' attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, please charge any fee to **Deposit Account No. 50-0876.**

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Respectfully submitted,

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